SEA FROST®

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SEA FROST BDxpx A/W
12 OR 24 VOLT
WITH AEO
AIR AND WATER COOLED SYSTEM

Description

The BDxpx is a pre-charged refrigeration/freezer system with component parts. Reseal able quick connect fittings are used to make leak tight connections between the plates and the remote compressor. These connectors may be disconnected without loosing refrigerant. The refrigerant used in the BDxpx is R-404a. R-404a has special handling requirements. It is a blend of three refrigerants and is a high-pressure refrigerant with good low temperature characteristics. The system uses a Danfoss BD 150 compressor. It is a permanent magnet brushless DC motor, hermetically sealed. The refrigerant is cooled by both air and water. Direct evaporator cold plates made of stainless steel and copper coils are cooled by the refrigerant and keep at the desired temperature by a thermostat cycling the compressor.

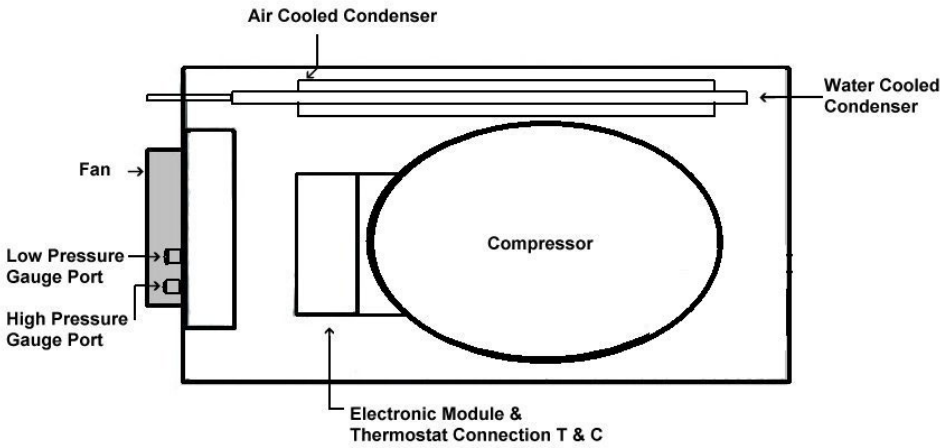
CONDENSING UNIT LOCATION AND MOUNTING

The water-cooling option should be considered supplemental cooling. Installation should proceed with a proper air-cooled installation first. The water-cooling feature should be used to enhance efficiency on occasions when cold-water temperatures are encountered or interior cabin air temperatures are extreme.

The design of the Sea Frost BDxpx compressor box allows placement in an enclosed space such as a cabin locker or sail locker. Intake air should be drawn in from the cabin area to insure the coolest, driest air supply. Standard 4" duct hose may be used. Discharge will need to be vented to allow warm air to escape. The fan may be un-screwed and turned over to reverse airflow.

Avoid intake ducting from the exterior of the boat this will cause damp salt air to be drawn in increasing corrosion. This will also increase below deck moisture.

ALLOW 1.5" CLEARANCE BETWEEN THE CONDENSER (BACK VENT AREA) AND ANY BULKHEAD TO INSURE PROPER AIRFLOW THROUGH THE CONDENSER.



BD XPX Plan View

Service access and installation requires that the front, left end (inlet) and back (condenser) air outlet be exposed. A duct hose will require 4 inches of clearance past the end of the cabinet.

Mount the compressor box level, (the compressor is at the bottom). The compressor box may be platform mounted. Two holes have been drilled through the bottom for screw mounting to a shelf or bulkhead. If using the bulkhead mount bracket kit, follow directions supplied with the kit.

INSTALLATION REQUIREMENTS FOR COMPRESSOR BOX

- Never block air inlet or outlet.
- Provide for driest, coolest air for intake.
- Fan may be turned over to reverse airflow.
- Total air duct length for intake should not exceed four feet and one bend.
- Make sure installation location is vented to allow discharge air to escape.

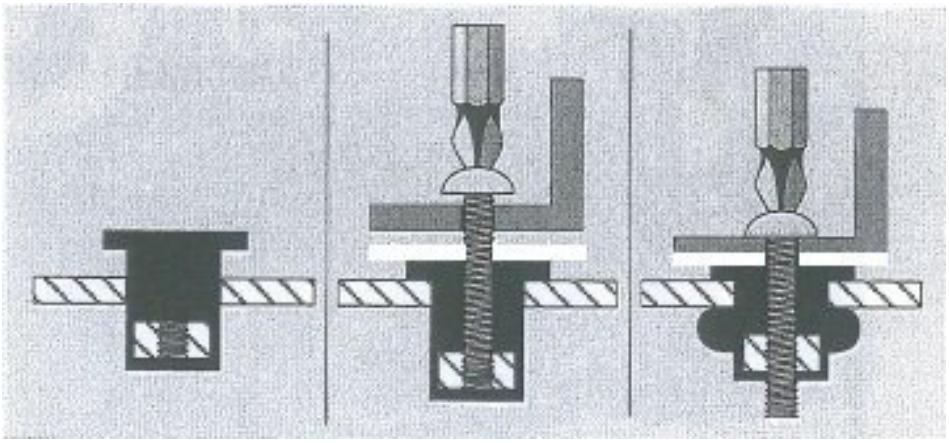
MOUNTING A FREEZER BIN

The Sea Frost Freezer Bin mounts with a Wellnut expandable neoprene blind hole fastener. A template or the stainless steel brackets should be used to locate the mounting holes. Drill 1/4" pilot holes then increase them to 1/2".

MOUNTING THE EVAPORATOR PLATE (s)

The plate(s) should be mounted in the cabinet as high as possible to take advantage of thermal convection. Plates can be used as a shelf, mounted on the ceiling or any wall. There is no restriction as to position. If a plate is wall mounted a vertical ice tray kit is available.

The Sea Frost BD plate mounts with a Wellnut expandable neoprene blind hole fastener. A template or the plate itself should be used to locate the mounting holes. Drill a 3/16" pilot hole. Increase this hole to 3/8".



1. Place Well-nut insert all the way into Pre-drilled hole until flange is firmly against mounting surface.	2. Pass Machine screw through part to be fastened and the white spacer washer.	3. Tighten until snug.

INSTALLING REFRIGERANT LINES

Two copper lines connect the stainless steel evaporator plate and the compressor. One is 5/16" and the other is 1/8". Run the lines behind any and all serviceable parts. Avoid heated engine spaces. Do not coil excess tubing in an engine space. Protect the lines from being crushed, snagged or stepped on.

The quick connect fittings require a 1 inch diameter clearance hole and are staggered to allow passing through a bulkhead or insulated wall. Keep the plastic cap and shrink wrap protective cover in place until the connections are made.

Plan to insulate the lines copper lines with Armorflex closed cell foam for at least three feet as they exit the insulated refrigerator /freezer.

WORK CAREFULLY WITH THE COPPER TUBES TO AVOID PINCHING OR KINKING THE TUBES. ALL BENDS SHOULD BE SMOOTH WITH NO LESS THAN A 2" RADIUS.

Support the tubing every 18 inches as necessary using tie wraps fastened with self-tapping screws. Insulate at least 3' of the line set as it exits the refrigerator box. Seal both sides of the exit holes in the refrigerator box with permagum sealing compound.

WARNING:

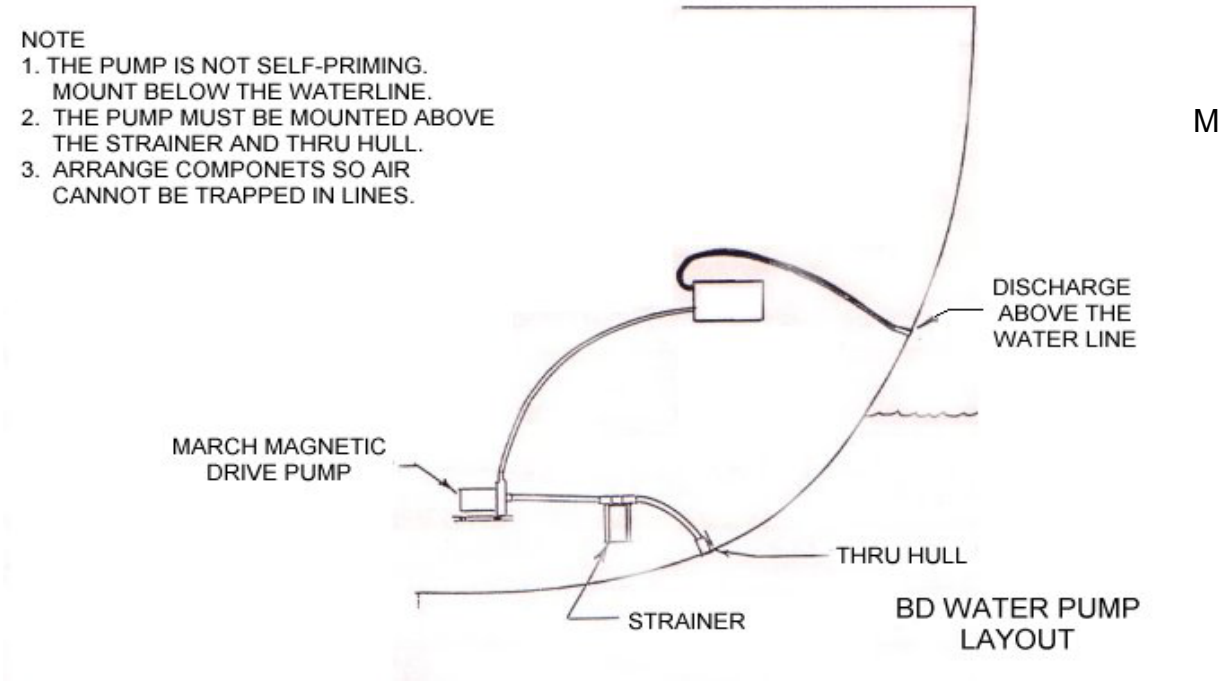
The Sea Frost BD system is shipped pre-charged with refrigerant. This refrigerant is under some pressure. Do not fiddle with the connectors or the service ports. You might get hurt! Wear safety glasses when connecting the compressor fittings.

COMPRESSOR CONNECTIONS

The connections in the BDxpx system are self-sealing when connecting and disconnecting. It is very important to inspect (and clean if necessary) the surfaces and "o" ring seals before assembly. If dirt, moisture, or grit, is on these connectors the system may be contaminated or the seal may be ruined.

Working with one line at a time, remove the heat shrink material and the plastic caps. Do not scratch or nick the end of the orange-capped fitting. This is a metal-to-metal seal. Connect the larger copper line to the compressor fitting. Connect the small copper line to the remaining fitting. Use two wrenches to tighten the fittings wrench snug then 1/8 turn. (See separate data sheet on connections.)

PUMP INSTALLATION ~ HOSE CONNECTIONS


NOTE
1. THE PUMP IS NOT SELF-PRIMING. MOUNT BELOW THE WATERLINE.
2. THE PUMP MUST BE MOUNTED ABOVE THE STRAINER AND THRU HULL.
3. ARRANGE COMPONETS SO AIR CANNOT BE TRAPPED IN LINES.
DISCHARGE ABOVE THE WATER LINE
MARCH MAGNETIC DRIVE PUMP
THRU HULL
STRAINER
BD WATER PUMP LAYOUT

M

PUMP INSTALLATION

For proper operation, please understand the pump installation before beginning. The BDxpx water-cooled uses a magnetically coupled centrifugal pump. It is not self-priming and must be well below the water line. Air pockets caused by loops or descending lines from one component to the other may cause pump problems. **This pump must never be run dry. It is water cooled and lubricated. The wet end may be destroyed if it is started dry.**

A separate through hull fitting 1/2" or larger should be used. It should be as low in the boat as possible and away from head and cockpit drains. A forward facing scoop will prevent problems if the unit is operating underway.

A seawater strainer should be mounted above the seacock.

The pump should be mounted horizontally. It should be higher than the strainer. The discharge should be on the top. A 3/8” hose should feed up hill to the BD unit. This should connect to the lower water fitting. From the upper water fitting a 3/8” hose should connect to a through hull above the water line.

For quiet operation suspend the pump on its hoses or mount using a rubber strip bolted to the pump body. Refer to the pump installation drawing at the end of this manual.

Two or more units on one pump

Connect the pump to the inlet fitting on the first unit. This should be the freezer compressor. The first unit is the lowest mounted in the boat and the connected to run the freezer. Connect the outlet to the inlet of the second unit. Connect the outlet of the second to the discharge or a third etc. Always connect the water circuit in series.

PUMP WIRING

Inside the compressor box connect the red pump wire to the (+) on the water pump relay. Connect the black wire to the (-) terminal (top row, right side) on the compressor module board. See drawing on page 12. Be sure the toggle switch is off until the boat is launched and the pump is wet.

WIRE SIZE

Refer to ABYC tables for wire sizes other than these:

12-volt installations use AWG #8 wire for distances up to 10 feet for the wire pair, and #6 AWG wire for distances up to 25 feet for the wire pair. **Fuse 30 Amps.**

24 Volts, halve the wire size of 12-volt installation. The module will self calibrate to the applied voltage and provide proper fan voltage. The remote water pump must be a 24volt pump. **Fuse 15 Amps.**

A buss or terminal may be installed next to the compressor in order to drop the wire size to 10 gauge for easier connection to the module.

If the polarity is reversed, the electronic module will not work.

For best performance, the electronic module must always be connected directly to the battery or battery selector switch. Connecting the module through the boat's breaker panel may cause a voltage drop; small wires and multiple connectors create resistance. In any application, use the next largest wire if in doubt, to prevent a voltage drop. A fuse is preferred over a breaker as it has less potential voltage drop. A fuse is not provided.

Compressor Connections

Connect a black or yellow wire from 12 or 24 volts negative to the (-) terminal board. This is the top row of terminals.

Connect a red wire from 12 or 24 volts positive to the (+) terminal of the terminal board. This is the second row of terminals.

Do not operate the BDxpx directly from a charger without a battery. Never apply power to any of the other terminals.

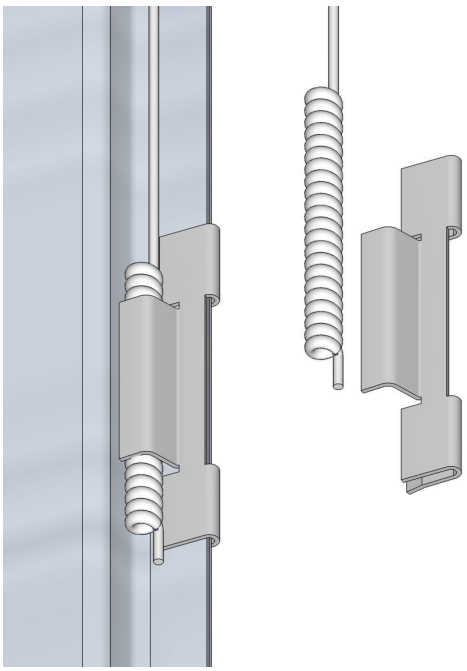
THERMOSTAT WIRING CONNECTIONS

Connect the thermostat wires at the compressor module to terminals C and T using 1/4" female crimp terminals. This is for AEO operation. **There is no polarity requirement**.

Remote (snowflake panel) thermostat wires ~ red.
Electronic thermostat thermometer (version 1) wires ~ green and white
Electronic thermostat thermometer (version 2 & 3) cat 5 data cable with RJ 45 connector. Install a 3-amp ATC fuse in the fuse holder on the Module PCB board. **The PBC board fuse is required only if using Electronic Thermostat with the RJ-45 jack.**

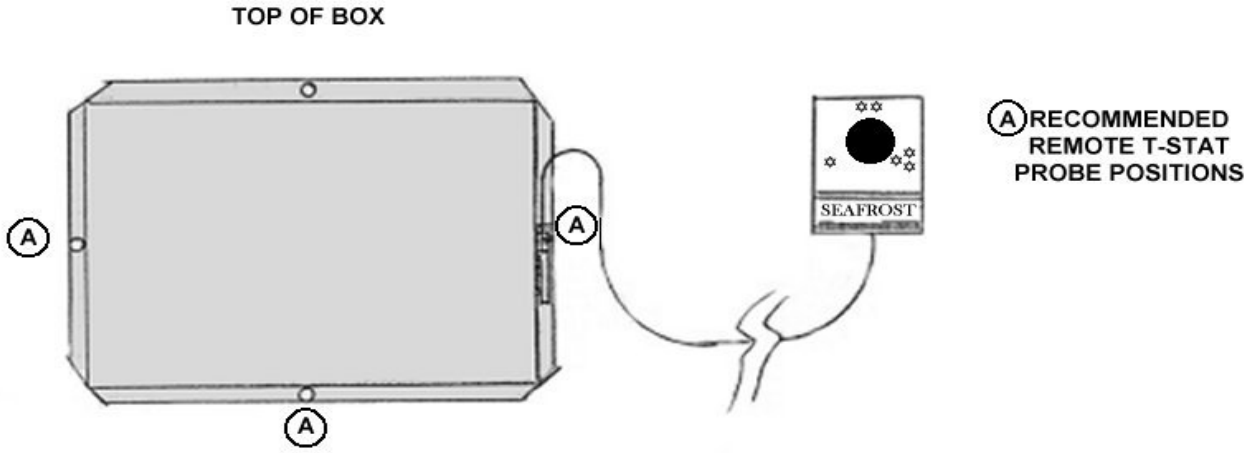
REMOTE THERMOSTAT INSTALLATION

Install the panel-mounted thermostat within 50 inches of the refrigerator/ freezer. The capillary sensing tube must enter the cabinet and reach to the side or bottom of the cold plate or the second plate in a two-plate hook up. The second plate is the plate without the expansion valve.



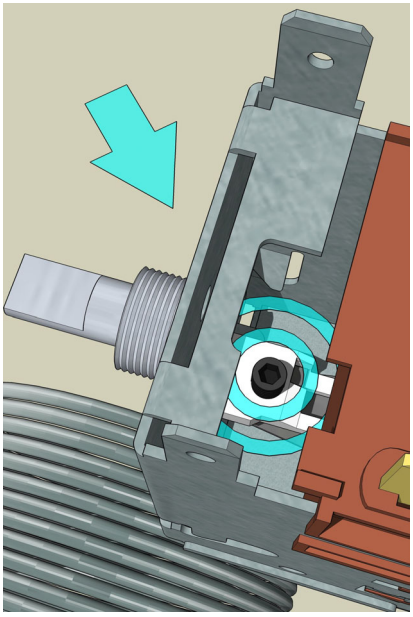
Make sure the thermostat capillary does not contact any tubing as it enters the cabinet. Pull all excess capillary into the insulated cabinet.

Slide the bulb clip onto the edge of the plate and over the sensing bulb as shown in the drawing to the right. The sensing bulb must be in excellent thermal contact with the plate. We recommend that the probe be mounted on the plate in one of the lower mounting positions as shown in the drawing below. This is best because these positions remain colder.



The SEA FROST BD (Snowflake) thermostat is variable. Turning the knob fully counterclockwise turns the unit "OFF". The fully clockwise setting is the coldest. The thermostat may be adjusted to obtain any temperature desired in the cabinet.

Calibration of the Remote Thermostat



The thermostat may be calibrated should the warmest setting be too cold. To calibrate the thermostat remove the mounting screws and tip the panel forward. About an inch into the case is a black adjustment screw.

To lower box temperature, rotate this screw counter clockwise. One full revolution will change the box temperature approximately 6 degrees F. To raise the temperature in the box rotate the screw clockwise.

Make small adjustments. Record all adjustments.

ELECTRONIC THERMOSTAT THERMOMETER (Option)

Follow the detailed instructions provided with the ETT.

OPERATION DESCRIPTION

Once installed the BDxpx is started by turning the thermostat clockwise from the off position. The BDxpx will run until the plate reaches the set temperature of the thermostat.

Turning the thermostat counter clockwise lowers the temperature at which the BDxpx will switch off. The BDxpx will remain off until the plate temperature rises about 10 degrees F. The BDxpx is either on or off. It will not cool faster with a colder setting. The SEA FROST BDxpx is a small system. It is efficient in its electrical conversion of energy to heat movement. By being small, it is quiet, compact, has low electrical starting requirements and running power draw, and is able to be air-cooled. It will take some time to cool a warm cabinet.

Pump Operation: The water pump has a switch on the left end of the compressor cabinet. With the pump switch on the pump will operated automatically when the compressor starts.

You may want to switch off the pump when leaving the boat unattended. This is especially important when jellyfish, seaweed and other trash is present in the water and could block the intake sea strainer. Be sure the pump is switched off when operating the system when the boat is out of the water.

Multiple Compressors With One-Pump Installation

Boats with two water-cooled BD units fitted may have only one water pump. The pump piping is connected in series, feeding the freezer compressor first. The pump is wired to both compressors. There is a switch on each unit that will control the pump. If both pump switches are **on** the pump will run when either compressor starts. If only one switch is **on** the pump will pump when that unit is on. Turn both pump switches **off** when the boat is hauled.

DEFROSTING

Excessive frost/ice build up on the plate will reduce the cooling effect by insulating the evaporator plate(s). Allowing the evaporator plate(s) to warm above freezing is one method of defrosting. Boiling water or a scraper will also work.

OPERATION INSPECTION

Within a few minutes of starting the Sea Frost BDxpx, the tubing in close proximity to the valve mounted on the plate and the valve itself will be noticeably cold. **IF AFTER 20 MINUTES OF OPERATION, COOLING IN THIS AREA IS NOT OBSERVED DO NOT CONTINUE TO OPERATE THE SYSTEM.**

IMPORTANT: When using the water pump, check water flow and periodically inspect and clean the seawater strainer.

OPERATIONAL INFORMATION

VOLTAGE	12 D.C. or 24 D.C.
AMP/HR DRAW	4.3 to 17.8 @ 12 VOLTS (Dependant upon compressor speed, low pressure valve setting, and condensing temp.) PUMP ADDS 1 AMP/HR .5 @ 24 VOLTS
LOW VOLTAGE CUT OFF	10.4 VOLTS @ 12 VOLTS 22.8 VOLTS @ 24 VOLTS
WIRE SIZE TO BATTERY SUPPLY	AWG # 8 TO 10 FEET AWG # 6 MAXIMUM 25 FEET
FUSE:	12 VOLT 30 AMP STANDARD AUTOMOTIVE 24 VOLT 15 AMP STANDARD AUTOMOTIVE

REFRIGERANT CHARGE

This system operates with refrigerant R-404a and is pre charged. The proper charge amount is 7 oz. An automatic/constant pressure valve regulates the evaporator pressure. This valve is factory pre-set to maintain a constant evaporator pressure of 15 psi.

Do not remove the plastic moisture cap on the expansion valve or turn the knob beneath it.

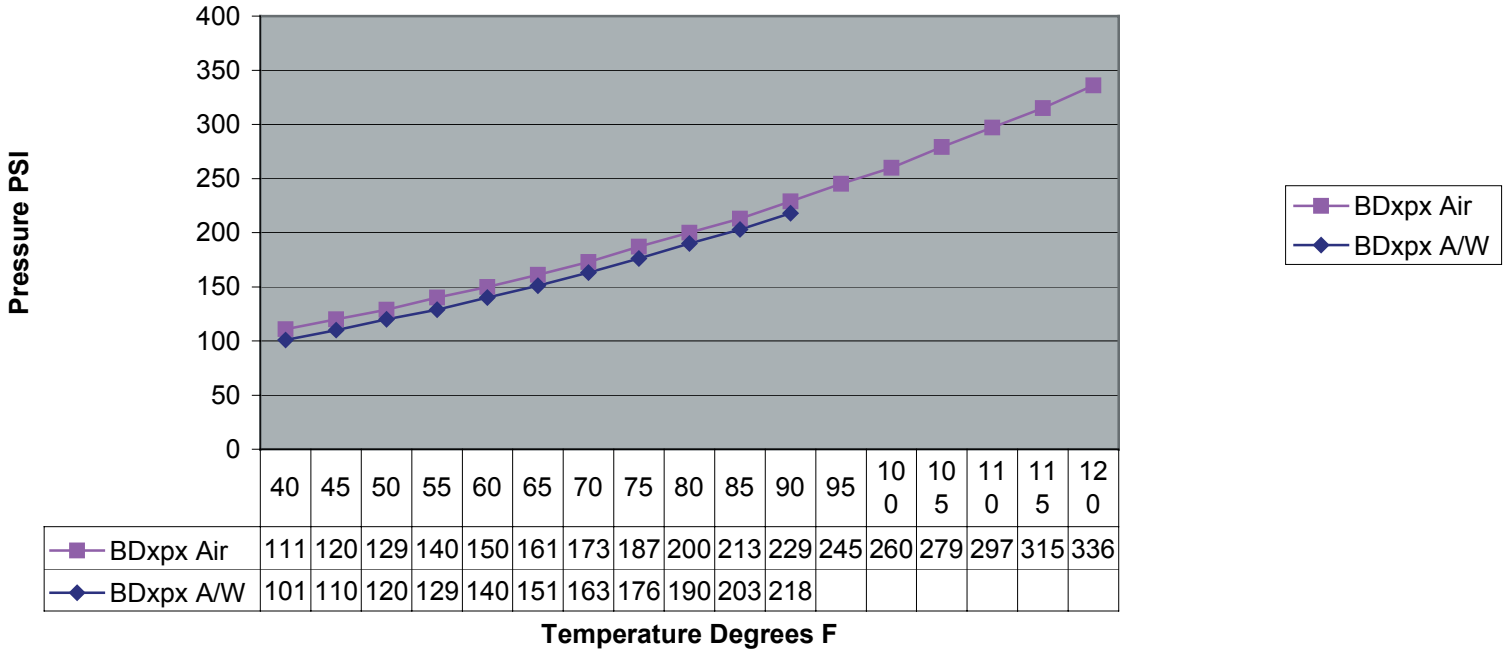
WARNING! Do not use refrigerant with any additives, including but not limited to: oil, dye, and leak stop.

The BDxpx is intended to operate only with the cover in place. This insures airflow through the air condenser.

Charge amount will not affect the evaporator pressure (low side pressure). If adjustment is needed be sure to reinstall the plastic moisture cap immediately.

High pressure operating pressures for both air and air/water cooling are charted. Allow 10% error.

BDxpx OPERATING PRESSURE
404A REFRIGERANT



	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
BDxpx Air	111	120	129	140	150	161	173	187	200	213	229	245	260	279	297	315	336
BDxpx A/W	101	110	120	129	140	151	163	176	190	203	218						

Temperature Degrees F

WATER COOLED MAINTENANCE

Drain all water from the pump, sea strainer, hoses and water coil in the BD housing when entering a freezing climate. Switch off the pump to avoid dry pump operation.

TROUBLESHOOTING

A light emitting diode (LED) is connected between terminals (fan **+)** and **D.** In case the electronic unit records an operational error, the diode will flash a number of times. The number of flashes depends on what kind of operational error was recorded. Each flash lasts 1/4 second. After the actual number of flashes there will be a delay with no flashes, the sequence for each error recording is repeated every 4 seconds. Flashes will only occur in the fault mode with the system on.

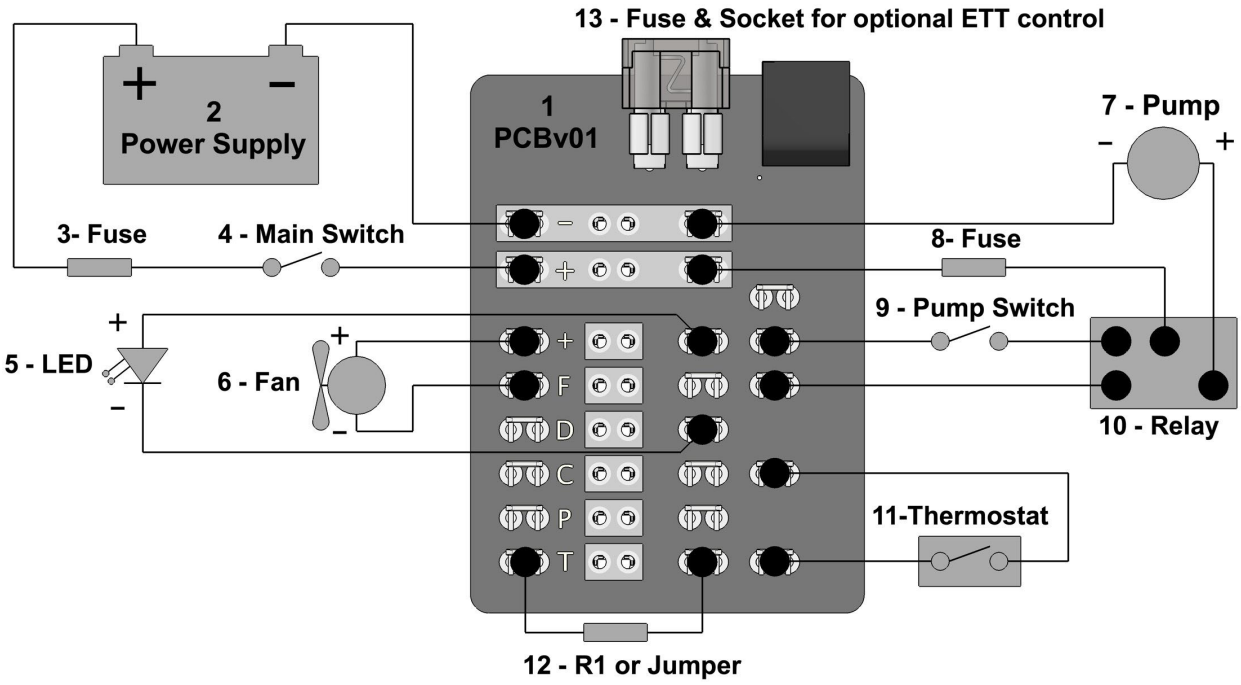
See additional trouble shooting information available at www.seafrost.com

OPERATIONAL ERRORS SHOWN BY LED

Number of flashes	Error type
5	**Thermal cut-out of electronic unit** (If the refrigeration system has been too heavily loaded, or if the ambient temperature is high, the electronic unit will run too hot).
4	**Minimum motor speed error** (If the refrigeration system is too heavily loaded, the motor cannot maintain minimum speed 1,850 rpm).
3	**Motor start error** **A.** (The system might be overcharged.) Has charge been added? **B**. Faulty module. **C.** This fault may also occur when the compressor is trying to start a warm system or on initial start up on a new system. Several attempts and then start up can be normal. ***Do not let out refrigerant until first contacting Seafrost!***
2	**Fan over-current cut-out** (The fan is defective).
1	**Battery protection cut-out** (The voltage is outside the cut-out setting. Low voltage.)

Operation of the fan or fan and pump with no faults and no cooling at the expansion valve indicates that the compressor has no refrigerant. Amp draw will be lower than normal running amps but should be above 5 amps. If this condition exists a leak has developed that will require fixing. Refrigerant will have to be added to restore operation. Switch off the unit until repairs can be made.

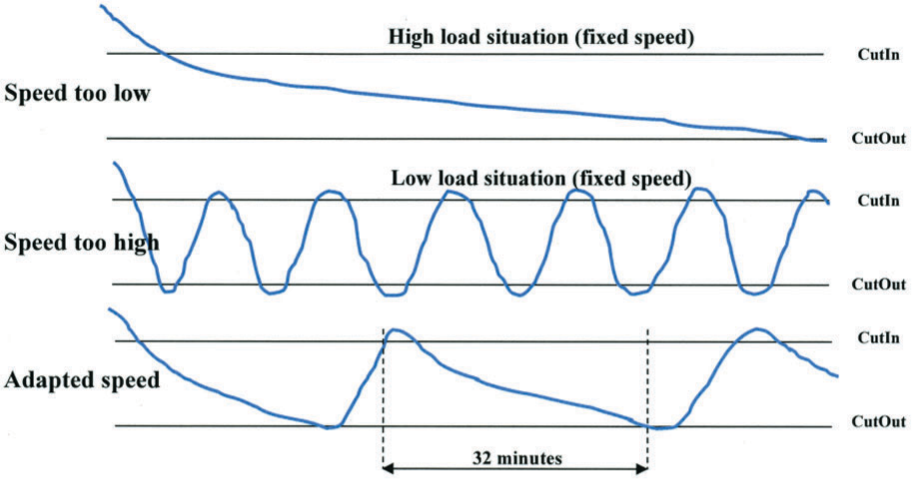
WIRING



NOTE: When using the modular thermostat connection (#13) there are no connections on thermostat terminals (#11).

1. Electronic unit **2.** Battery **3.** Fuse **4.** Main switch (optional) **5.** LED for operational errors **6.** Fan **7.** Pump **8.** Fuse 7 amp	**9.** Pump Switch **10.** Relay **11.** Thermostat **12.** R1- Resister for pre-setting speed (optional) or Jumper for AEO module **13.** 3 amp Fuse & RJ45 jack for optional Electronic Thermostat.

AEO function Part # 101N0300

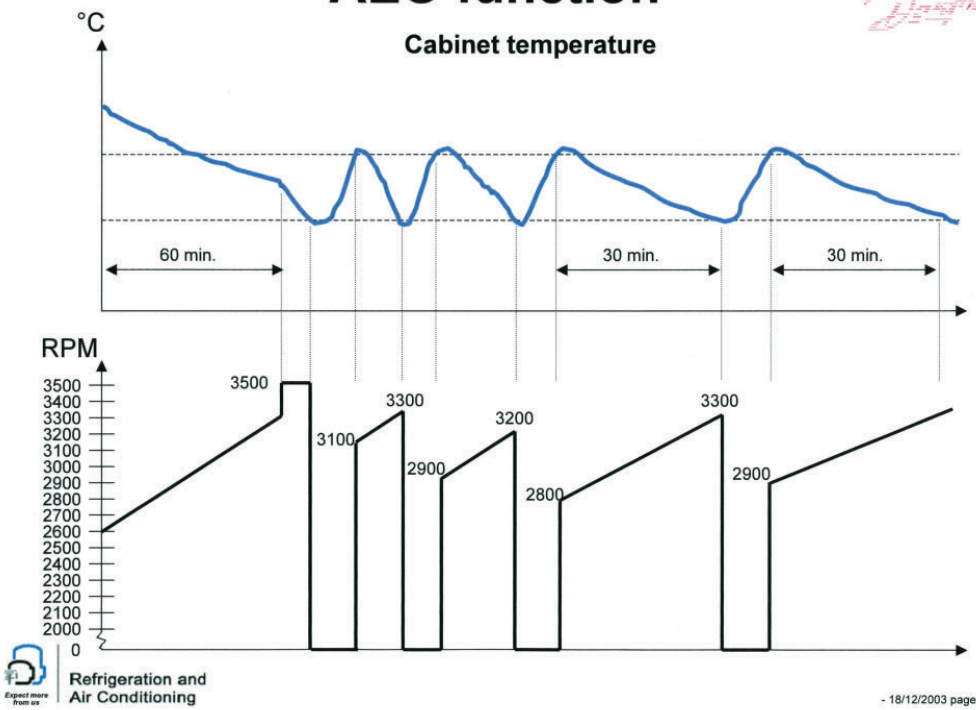


- Independent of load variations
- Reduces number of starts
- Prevents short cycling of the compressor
- Battery protection

Refrigeration and Air Conditioning

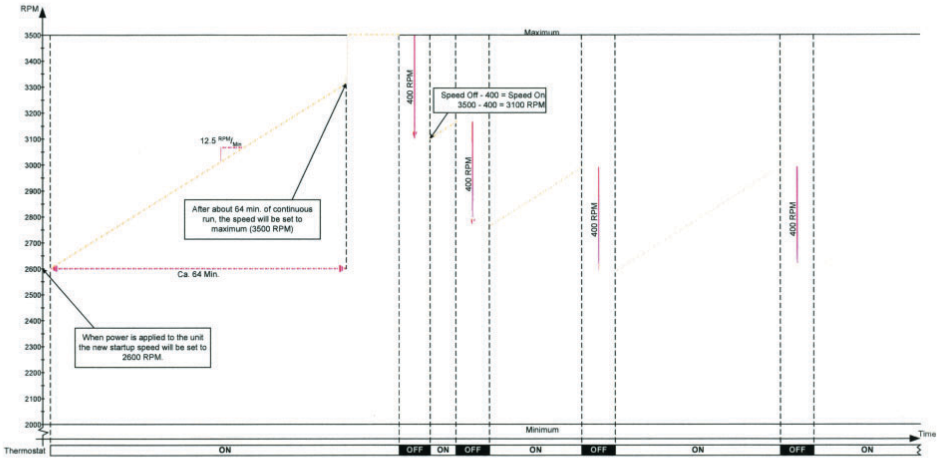
AEO function

Cabinet temperature



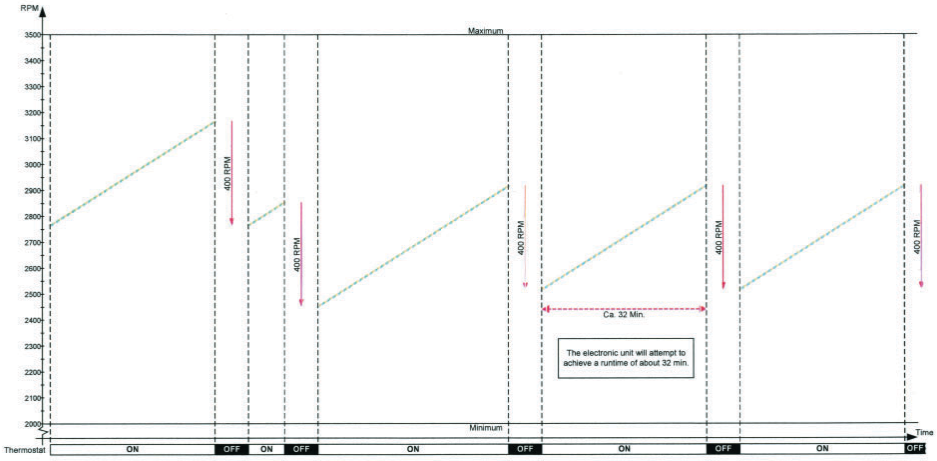
Refrigeration and Air Conditioning

AEO function


RPM
Maximum
Minimum
Time
Thermostat
ON
OFF
400 RPM
Speed Off - 400 = Speed On
3500 - 400 = 3100 RPM
12.5 RPM/Min
After about 64 min. of continuous run, the speed will be set to maximum (3500 RPM)
Ca. 64 Min.
When power is applied to the unit the new startup speed will be set to 2600 RPM.

- When the thermostat is switched on for the first time, after the power was applied to the unit, then the new startup speed will be set to 2600 RPM.
- If the compressor is stopped, then the speed it had will be used to calculate the next start-up speed (Speed off – 400 = New Start-up Speed).
- If the compressor is not stopped within 64 min., then the speed will be set to 3500 rpm (Maximum).

AEO function



- The start-up speed will be adjusted to achieve a runtime of about 32 min.
- This adjustment is done by increasing the speed every minute and reducing the start-up speed.

Our Repair Policy

Your **Sea Frost BD** system is manufactured to the highest standards and thoroughly tested. If you experience problems with your system requiring technical service, return it to us freight prepaid.

When a system is returned to us we will fix manufacturing defects and failures occurring in normal operation for one year from the date of purchase or from the date of first usage/commissioning at no charge, and return it to you freight prepaid (surface freight) anywhere in the continental United States. Installation damage and damage to the electrical parts will be favorably considered however this damage is not our responsibility.

Improper wiring, improper voltage, corrosion, and water damage are not considered manufacturing defects. It is your job to install and maintain your system in a reasonable manner to prevent possible problems.

Proper installation and reasonable care will give you many years of excellent operation. Please notify us before returning your system for repair.

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